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Chapter 3

Uncertainties in Lamp Standards

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ABSTRACT

The uncertainties associated with the use of lamp standards was estimated by using several lamps with different calibration histories to illuminate a NIST reflectance standard (T005), and then comparing the calibrated radiance from the plaque (calculated from the calibrated reflectance of the plaque and the calibrated irradiance from the lamp), with that measured by the SXR. The average uncertainty of the most *trusted* lamps, those with no known problems and established good performance capabilities, was approximately 1.2%. All of the lamps had a calibration repeatability less than 0.5%, and all of the lamps except one had a repeatability less than 0.2%. A comparison of an Optronic calibration of an FEL lamp with a NIST calibration of the same lamp showed an overall average agreement to within approximately 1.3%. A similar comparison exercise executed as a part of SIRREX-5 showed the Optronic calibration of FEL F-409 differed from the NIST calibration by an average of approximately 2.6%, whereas a second calibration by Optronic differed from the NIST calibration by about 0.8%.

3.1 INTRODUCTION

Three experiments were conducted to examine the uncertainties associated with using lamps during calibrations. The first involved using a NIST reflectance standard and the SXR to estimate the uncertainties in using Labsphere (Spectralon) plaques, the second quantified how much of the variability in calibrations is due to changes in the lamp from one calibration session to the next, and the third compared the NIST and Optronic calibrations for a newly purchased lamp.

3.2 LAMP UNCERTAINTIES

The uncertainties associated with the use of lamp standards was estimated by using several lamps with different calibration histories to illuminate a NIST reflectance standard (T005), and then comparing the calibrated radiance from the plaque (calculated from the calibrated reflectance of the plaque and the calibrated irradiance from the lamp), with that measured by the SXR. A monitoring

sensor (R035) was mounted on the rail opposite the SXR to provide an independent measure of the illumination stability of the plaque.

3.2.1 Equipment

The equipment used for determining the uncertainties in lamp standards involved the following:

- Satlantic NIST lamp F-409 (L007), and SeaWiFS NIST lamps F-182 (L002) and F-137 (L001);
- JRC Hoffman Lamps H97505 (L004) and H96551 (L005);
- Satlantic Optronic lamps F-539, F-536, and F-516 (L003, L006, and L000, respectively), plus two new Satlantic Optronic lamps F-547 (L008) and F-548 (L009);
- NIST plaque K299 (T005);
- The SXR (X001) with custom mount and digital voltmeter (V003);